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Proposed Best Demonstrated Available Technology (BDAT) Background Document for Distillation Bottoms from the Production of Nitrobenzene by the Nitration of Benzene K025. Volume 11

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This background document provides the Agency's rationale and technical support for selecting the constituents for proposed regulation in K025 and for developing treatment standards for these constituents. The document also provides waste characterization data that serve as a basis for determining whether a variance from a treatment standard may be warranted for a particular type of K025 that is more difficult to treat than the wastes that were analyzed in developing treatment standards for K025.

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PROPOSED

BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)

BACKGROUND DOCUMENT

FOR

DISTILLATION BOTTOMS FROM THE PRODUCTION OF NITROBENZENE

BY THE NITRATION OF BENZENE

K025

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Note: This proposed Background Document is being issued in support of the Agency's proposed rulemaking for the land disposal restrictions program. The Agency solicits comments on the proposed rule and on this proposed Background Document. This document will be issued in final form, appropriately revised in response to comments, at the time of promulgation of the final rule.

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1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA or Agency) is proposing to establish best demonstrated available technology (BDAT) treatment standards for the listed hazardous waste identified in Title 40, Code of Federal Regulations, Section 261.32 (40 CFR 261.32) as K025, distillation bottoms from the production of nitrobenzene by the nitration of benzene. These BDAT treatment standards are being established in accordance with the amendments to the Resource Conservation and Recovery Act (RCRA) of 1976, enacted by the Hazardous and Solid Waste Amendments (HSWA) of November 8, 1984. BDAT treatment standards will be effective no later than May 8, 1990, and on or after the effective date, compliance with these BDAT treatment standards will be a prerequisite under 40 CFR Part 268 for placement of the waste in land disposal units.

This background document provides the Agency's rationale and technical support for selecting the constituents for proposed regulation in K025 and for developing treatment standards for these constituents. The document also provides waste characterization data that serve as a basis for determining whether a variance from a treatment standard may be warranted for a particular type of K025 that is more difficult to treat than the wastes that were analyzed in developing treatment standards for K025.

The Agency's legal authority and promulgated methodology for establishing treatment standards and the petition process necessary for requesting

a variance from the treatment standards are summarized in EPA's Methodology for Developing BDAT Treatment Standards (Reference 1).

This background document presents waste-specific information on the number and locations of facilities that may be affected by the land disposal restrictions for K025, the processes generating this waste, the waste characterization data, the technologies used to treat the waste (or similar wastes, if any), and the treatment performance data on which the proposed treatment standards are based (Sections 2.0 - 4.0). This document also explains how EPA determines BDAT, selects constituents to be regulated, and calculates treatment standards (Sections 5.0 - 7.0).

Under 40 CFR 261.32, wastes identified as K025 are listed as follows:

> K025 - Distillation bottoms from the production of nitrobenzene by the nitration of benzene.

The four-digit Standard Industrial Classification (SIC) code associated with the production of nitrobenzene is 2865. The Agency estimates that there is one domestic facility that may generate K025.

The Agency is proposing to revise the "No Land Disposal Based on No Generation" treatment standard that was promulgated for nonwastewater forms of K025 and is proposing treatment standards for wastewater forms of K025, which have been subject to the "soft hammer" provisions of Section 3004(g)(6) of RCRA. The "No Land Disposal" standard for K025 nonwastewaters was based on

the premise that K025 is no longer generated. The Agency believes that this standard should be revised for several reasons: (1) a facility intending to manufacture nitrobenzene in the future by the nitration of benzene, and generating distillation bottoms as a result, would be forced to apply for a variance from the treatment standard (40 CFR 268.44); (2) a facility disposing of K025 from past nitrobenzene manufacturing operations as part of a corrective action would also be forced to apply for a variance from the treatment standard; and (3) a facility changing its treatment process from one that originally did not generate treatment residuals to one that may generate residuals would be forced to apply for a variance from the treatment standard.

The Agency is proposing three organic constituents for regulation in nonwastewater and wastewater forms of K025. To determine the applicability of the treatment standards, wastewaters are defined as wastes containing less than 1% (weight basis) total suspended solids[1] (TSS) and less than 4% (weight basis) total organic carbon (TOC). Wastes not meeting this definition are classified as nonwastewaters and must comply with nonwastewater treatment standards.

The Agency does not have any performance data on the treatment of K025. Treatment performance tests for this waste have not been pursued

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[1]The term "total suspended solids" (TSS) clarifies EPA's previously used terminology of "total solids" and "filterable solids". Specifically, total suspended solids is measured by Method 209C (total suspended solids dried at 103-105°C) in Standard Methods for the Examination of Water and Wastewater, Sixteenth Edition (Reference 2).

because the Agency believes that adequate treatment performance data are available from similar wastes previously tested by the BDAT Land Disposal Restrictions Program. Therefore, treatment performance data were transferred to K025 from other previously tested wastes.

For nonwastewater forms of K025, proposed BDAT treatment standards are based on treatment performance data transferred from incineration of U and P wastes in Test 14 (Reference 3). (The specific wastes that were incinerated are listed in Table 4-1 of this document.)

For wastewater forms of K025, proposed BDAT treatment standards are based on treatment performance data transferred from liquid-liquid extraction followed by steam stripping and activated carbon adsorption of K103 and K104.

Tables 1-1 and 1-2 at the end of this section list the proposed BDAT treatment standards for nonwastewater and wastewater forms of K025. These proposed treatment standards are based on the total concentration of each constituent in the waste. The units used for total constituent concentration of organic constituents are mg/kg (parts per million on a weight-by-weight basis) for K025 nonwastewaters, and mg/l (parts per million on a weight-by-volume basis) for K025 wastewaters. If the concentrations of the constituents proposed for regulation in K025 nonwastewaters and wastewaters, as generated, are lower than or equal to the proposed treatment standards, then treatment of the waste would not be required prior to "land disposal," as defined by 40 CFR Part 268.

EPA is also proposing to establish a method of treatment as the treatment standard for nonwastewater and wastewater forms of K025 as an alternative to specifying numerical treatment standards. The Agency is proposing this alternate treatment standard because it is uncertain whether other constituents, which may not be controlled for by regulation of the BDAT List constituent proposed for regulation, are present in K025, due to a lack of characterization data for K025. These alternative treatment standards are shown in Tables 1-1 and 1-2, for nonwastewater and wastewater forms of K025, respectively.

Table 1-1

PROPOSED BDAT TREATMENT STANDARDS FOR K025

NONWASTEWATERS

Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Concentration (mg/kg)
102. 2,4-Dinitrotoluene	2.3
126. Nitrobenzene	2.3
127. 4-Nitrophenol	2.3

Or

INCINERATION AS A METHOD OF TREATMENT

Table 1-2

PROPOSED BDAT TREATMENT STANDARDS FOR K025

WASTEWATERS

Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Concentration (mg/l)
102. 2,4-Dinitrotoluene	0.67
126. Nitrobenzene	0.084
127. 4-Nitrophenol	0.67

Or

INCINERATION OR LIQUID-LIQUID EXTRACTION FOLLOWED BY STEAM STRIPPING AND CARBON ADSORPTION AS A METHOD OF TREATMENT

2.0 INDUSTRY AFFECTED AND WASTE CHARACTERIZATION

This section describes the industries that may be affected by the land disposal restrictions for K025, the processes generating the waste, and available waste characterization data. All tables and figures are presented at the end of this section.

2.1 Industry Affected and Process Description

K025 is generated as distillation bottoms from the production of nitrobenzene by the nitration of benzene. The primary use of nitrobenzene is in the manufacture of aniline dyes. Nitrobenzene is also used as a solvent or in the manufacture of pharmaceuticals. The Agency has identified one potential generator of K025: Rubicon, Inc. located in Geismar, Louisiana in EPA Region VI (Reference 4).

A flow diagram illustrating a typical nitrobenzene production process is presented in Figure 2-1. Nitrobenzene is produced by the direct nitration of benzene using a sulfuric acid-nitric acid mixture. After a 2-4 hour reaction residence time, the mixture is sent to a decanter and allowed to settle. The mixed acids are recovered and reused. The crude nitrobenzene taken from the top of the decanter can be used directly for aniline production or sent on for further refinement. To be refined, the crude product is sent to a washer where it is neutralized with a dilute sodium carbonate solution and then distilled. Bottoms from distillation comprise the listed waste K025.

2.2 Waste Characterization

Available data sources (References 5 and 6) indicate the following general composition for K025:

Constituent	Concentration (%)
2,4-Dinitrotoluene	18.6
Nitrobenzenes	71.5
Nitrophenols	3.1
Other polymers containing nitrogen	3.7
Polycarboxylic acids	3.1
Total:	100%

Specific K025 characterization data are presented in Table 2-1 at the end of this section.

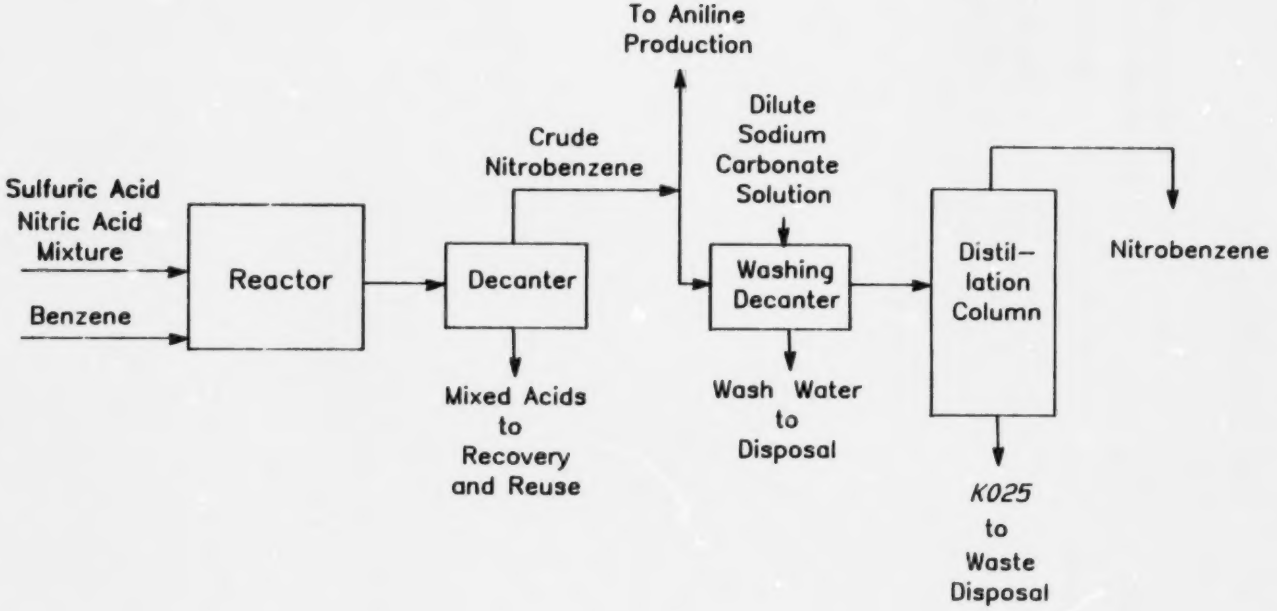

Figure 2–1. Flow Diagram for the Production of Nitrobenzene by the Nitration of Benzene

Table 2-1

KO25 CHARACTERIZATION DATA

BDAT List Constituent	Concentration in Untreated Waste (ppm)
102. 2,4-Dinitrotoluene	186,000
126. Nitrobenzene	404,000
127. 4-Nitrophenol	31,000

3.0 APPLICABLE AND DEMONSTRATED TREATMENT TECHNOLOGIES

This section discusses the technologies that are applicable to treatment of K025 nonwastewaters and wastewaters and determines which, if any, of the applicable technologies can be considered demonstrated for the purpose of establishing BDAT.

To be applicable, a technology must theoretically be usable to treat the waste in question or a waste that is similar in terms of parameters that affect treatment selection. (Detailed descriptions of technologies that are applicable to listed hazardous wastes are provided in EPA's Treatment Technology Background Document (Reference 7). To be demonstrated, a technology must be employed in full-scale operation for treatment of the waste in question or a similar waste. Technologies available only at pilot- or bench-scale operations are not considered in identifying demonstrated technologies.

3.1 Applicable Treatment Technologies

The following subsections present applicable treatment technologies for nonwastewater and wastewater forms of K025.

Nonwastewaters

Since nonwastewater forms of K025 consist primarily of organic compounds (as shown in Section 2.0 of this document), applicable treatment

technologies include those that destroy or reduce the total amount of various organic compounds in the waste. The Agency has identified the following treatment technologies as potentially applicable for these wastes: (1) incineration (fluidized bed and rotary kiln); (2) solvent extraction followed by incineration or recycle of the extract; and (3) critical fluid extraction followed by recycle or incineration of the contaminated solvents.

Incineration. Incineration is a destruction technology in which energy, in the form of heat, is transferred to the waste to destabilize chemical bonds and destroy organic constituents. In a fluidized bed incinerator, waste is injected into the fluidized bed material (generally sand and/or incinerator ash), where it is heated to its ignition temperature. Heat energy from the combustion reactions is then transferred back to the fluidized bed. Ash is removed periodically during operation and during bed change-outs.

In a rotary kiln incinerator, wastes are fed into the elevated end of the kiln, and the rotation of the kiln mixes the waste with hot gases to heat the waste to its ignition temperature. Ash is removed from the lower end of the kiln. Combustion gases from the kiln enter the afterburner for complete destruction of organic waste constituents. Other wastes may also be injected into the afterburner.

Combustion gases from the fluidized bed or kiln afterburner are then fed to a scrubber system for cooling and removal of entrained particulates and

acid gases, if present. In general, two residuals are generated by incineration processes: ash and scrubber water.

Solvent Extraction. Solvent extraction is a separation technology in which organics are removed from the waste due to greater constituent solubility in the solvent phase than in the waste phase. This technology results in the generation of two treatment residuals: a treated waste residual and an extract. The extract may be recycled or further treated by incineration.

Critical Fluid Extraction. Critical fluid extraction is a solvent extraction technology in which the solvent is brought to its critical state to aid in the extraction of organic constituents from the wastes. After the extraction step, the solvent (liquefied gas at its critical state) is brought to its normal condition in the gaseous state and generates a small volume of extract that is concentrated in hazardous organic constituents. This technology results in the generation of two treatment residuals: a treated waste and an extract. The extract may be recycled or further treated by incineration.

Wastewaters

Since wastewater forms of K025 may contain organic constituents at treatable concentrations, applicable technologies include those that destroy or reduce the total amount of various organic compounds in the waste. The Agency has identified the following treatment technologies as potentially

applicable for treatment of K025 wastewaters: (1) incineration; (2) steam stripping; (3) biological treatment; (4) carbon adsorption; (5) solvent extraction; and (6) wet air oxidation.

Incineration. Incineration of wastewaters in a rotary kiln or fluidized bed is identical to that for nonwastewaters described previously in this section. In addition, liquid injection incineration may also be applicable to K025 wastewaters.

In a liquid injection incinerator, liquid wastes are atomized and injected into the incinerator. Combustion gases from the incinerator are then fed to a scrubber system for cooling and removal of entrained particulates and acid gases, if present. In general, only wastes with low or negligible ash content are amenable to liquid injection incineration. Therefore, this technology generally does not result in the generation of an ash residual.

Steam Stripping. Steam stripping is a separation technology in which organics are removed from the waste by volatilization through the application of heat. This technology results in the formation of two treatment residuals: a treated waste extract and a treated effluent. The treated waste extract and the treated effluent may require further treatment by incineration, and carbon adsorption or biological treatment, respectively.

Biological Treatment. Biological treatment is a destruction technology in which organic constituents in wastewaters are biodegraded. This

technology results in the formation of two treatment residuals: a treated effluent and a waste biosludge. The treated effluent and the waste biosludge may require further treatment for metals by chemical precipitation and stabilization, respectively.

Carbon Adsorption. Carbon adsorption is a separation technology in which organic constituents in wastewaters are selectively adsorbed onto activated carbon. This technology results in the formation of two treatment residuals: a treated effluent and spent activated carbon. The treated effluent may require further treatment for metals by chemical precipitation. The spent carbon may require further treatment by incineration.

Solvent Extraction. Solvent extraction of wastewaters is identical to that for nonwastewaters described previously in this subsection.

Wet Air Oxidation. Wet air oxidation is a destruction technology in which organic constituents in wastes are oxidized and destroyed under pressure at elevated temperatures in the presence of dissolved oxygen. This technology is applicable for wastes comprised primarily of water and up to 10% total organic concentration. Wet air oxidation results in the formation of one treatment residual: treated effluent. The treated effluent may require further treatment for organic constituents by carbon adsorption or PACT^{R} treatment, as described in this subsection. Emissions from wet air oxidation may require further treatment by incineration.

PACT® Treatment. PACT treatment is the addition of powdered activated carbon to a biological treatment process. This technology results in the formation of two treatment residuals: a treated effluent and a waste biosludge. The treated effluent and the waste biosludge may require further treatment for metals by chemical precipitation and stabilization, respectively. In addition, the waste biosludge may require further treatment by incineration.

3.2 Demonstrated Treatment Technologies

The Agency is not aware of any facilities that treat K025 nonwastewaters. However, incineration is demonstrated for similar wastes, as discussed in Section 4.0 of this document.

The Agency is not aware of any facilities that treat K025 wastewaters. However, incineration and liquid-liquid extraction followed by steam stripping and activated carbon adsorption is demonstrated for similar wastewaters. The Agency tested both incineration and liquid-liquid extraction followed by steam stripping and activated carbon adsorption for similar wastes, as discussed in Section 4.0 of this document.

The Agency is not aware of any other technologies that are demonstrated for treatment of K025.

4.0 TREATMENT PERFORMANCE DATA BASE

This section presents the treatment performance data that were used to develop proposed treatment standards for nonwastewater and wastewater forms of K025.

Where data are not available on the treatment of the specific waste of concern, the Agency may elect to transfer performance data from a demonstrated technology that treats a similar waste or wastes. EPA's methodology for the transfer of treatment performance data is provided in EPA's Methodology for Developing BDAT Treatment Standards (Reference 1). Transfer of treatment performance data is technically valid in cases where the untested wastes are generated from similar industries or similar processing steps, or have similar waste characteristics affecting treatment selection and performance that are similar to those of the tested wastes.

The Agency does not have treatment performance data for treatment of K025 nonwastewaters or wastewaters. However, treatment performance data were available from other wastes previously tested by EPA and were transferred to develop proposed treatment standards for K025. Sources of treatment performance data for potential transfer to K025 include wastes previously tested by incineration (rotary kiln or fluidized bed incineration) for nonwastewaters and liquid-liquid extraction followed by steam stripping and activated carbon adsorption for wastewaters. These technologies were identified as applicable

and demonstrated for treatment of these wastes, as discussed in Section 3.0 of this document.

4.1 Nonwastewaters

Previous incineration tests conducted by the Agency are listed in Table 4-1 at the end of this section. EPA examined the wastes incinerated in these tests to identify the best data source(s), if any, for transfer of treatment performance data to K025 nonwastewaters. Specifically, EPA examined (1) whether the untested K025 is generated from a similar industry or processing step and (2) whether the waste has similar waste characteristics as those previously tested wastes.

Wastes included in Tests 3, 4, 5, 11, 12, 13, and 14 are generated by the organic chemicals industry, as is K025. Unlike these previously tested wastes, K025 is generated in the production of nitrobenzene as distillation bottoms and consists of nitrogenated organic compounds. However, the mixture of U and P wastes incinerated in Test 14 (Reference 3) was similar to K025 in that it was also an organic, nitrogen-containing waste with low water content.

Wastes incinerated in Test 14 are expected to have similar thermal conductivities to K025. Although the constituents of concern in K025 were not incinerated in Test 14, several of the U and P wastes incinerated were similar to these constituents with respect to structure: both the constituents in K025 and the wastes represented in Test 14 included aromatic and

organonitrogen compounds and alcohols. In addition, the wastes incinerated in Test 14 were similar to K025 with respect to physical properties that affect the treatment performance of incineration, such as boiling points. Because of these similarities, it is believed that treatment performance similar to that achieved for the surrogate U and P wastes incinerated in Test 14 could be achieved for K025.

Based on the similarities discussed above, treatment standards for constituents being proposed for regulation in K025 nonwastewaters were developed based on treatment performance data transferred from rotary kiln incineration of surrogate U and P wastes in Test 14 (Reference 3).

Surrogate waste forms of U141, U028, P020, U112, U226, U239, U080, U220, U166, U161, and U188 were incinerated in the Third Third Incineration Treatability Test (Reference 3). All of these wastes, along with clean fill soil, were fed to the rotary kiln. The ash generated from rotary kiln incineration results from treatment of these wastes. Table 4-2 presents the BDAT List constituents detected in the untreated wastes collected by EPA from the rotary kiln incineration treatment system used in Test 14, and Table 4-3 presents the BDAT List constituents detected in the kiln ash residual from Test 14. Design and operating data for the rotary kiln and secondary combustor used in Test 14 are presented in Table 4-4. Additional details of this test may be found in the Onsite Engineering Report for the Third Thirds Incineration Treatability Test (Reference 3).

4.2 Wastewaters

The Agency examined all of the available wastewater treatment performance data. Treatment of K103/K104 by liquid-liquid extraction followed by steam stripping and activated carbon adsorption was the sole source of data for the constituents of interest. EPA examined the K103 and K104 to evaluate whether transferring those treatment performance data to K025 is appropriate. Specifically, EPA examined (1) whether the untested K025 is generated from a similar industry or processing step and (2) whether the waste has similar waste characteristics affecting treatment performance as do those previously tested wastes.

K103 is generated during aniline production, and both K025 and K104 are generated during nitrobenzene production. K025 is generated as distillation bottoms from the production of nitrobenzene, K103 is generated as process residues from the production of aniline, and K104 is the combined wastewater streams generated during nitrobenzene and aniline production. Therefore, the industries generating these wastes were judged to be similar.

After determining that the wastes were generated by similar industries, EPA examined the relative treatability of K025 wastewaters and K103/K104 wastewaters. As discussed in the Treatment Technology Background Document (Reference 7), waste characteristics that affect treatment performance of liquid-liquid extraction followed by steam stripping and carbon

adsorption include the boiling points of the waste constituents and the concentrations of total organic carbon, total suspended solids, oil and grease, and volatile organic compounds in the wastes.

K025 and K103/K104 are expected to contain the same, or similar, constituents of concern and so, would be expected to have similar boiling points. The wastes are expected to have similar concentrations of volatile organic compounds, total organic carbon, total suspended solids, and oil and grease. Because of these similarities, the wastes are believed to be similar and are expected to be treated to similar concentrations by liquid-liquid extraction followed by steam stripping and activated carbon adsorption.

Based on these analyses, transfer of treatment performance data from K103/K104 to K025 wastewaters was judged to be valid. Data for the K103 and K104 untreated waste are presented in Table 4-5. Treatment performance data for liquid/liquid extraction followed by steam stripping and activated carbon adsorption are included in Table 4-6 and design and operating data are included in Table 4-7. Additional details of this test may be found in the Onsite Engineering Report for K103 and K104 (Reference 8).

Table 4-1

WASTES TESTED BY INCINERATION AND SAMPLED BY EPA

Test Number	Waste Code(s)	Treatment Technology Used
1	K001 - Pentachlorophenol waste	Rotary kiln incineration
2	K001 - Creosote waste	Rotary kiln incineration
3	K011, K013, K014	Rotary kiln incineration
4	K019	Rotary kiln incineration
5	K024	Rotary kiln incineration
6	K037	Rotary kiln incineration
7	K048, K051	Fluidized bed incineration
8	K087	Rotary kiln incineration
9	K101	Rotary kiln incineration
10	K102	Rotary kiln incineration
11	F024	Rotary kiln incineration
12	K015	Liquid injection incineration
13	D014, D016, P059*, U127*, and U192*	Rotary kiln incineration
14	U141*, U028*, P020*, U112*, U226*, U239*, U080*, U220*, U166*, U161*, and U188*	Rotary kiln incineration

*Commercial chemical products were used in these test burns as surrogates for these wastes.

Table 4-2

WASTE CHARACTERIZATION DATA COLLECTED BY EPA FOR
WASTES INCINERATED IN TEST 14

BDAT List Constituent	Concentration in the Untreated Waste Fed to the Rotary Kiln (ppm) MIX-L[a]
VOLATILE ORGANICS	
38. Methylene chloride	87,000
229. Methyl isobutyl ketone	52,000
43. Toluene	69,000
45. 1,1,1-Trichloroethane	130,000
SEMIVOLATILE ORGANICS	
70. Bis(2-ethylhexyl)phthalate	28,000
73. Dinoseb	77,000
117. Isosafrole	35,000
122. 1,4-Naphthoquinone	9,900
142. Phenol	13,000
METALS	
156. Barium	0.42
158. Cadmium	1.2
159. Chromium (total)	1.2
160. Copper	9.8
161. Lead	4.4
163. Nickel	2.0
168. Zinc	17.3
INORGANICS	
169. Cyanide	3.56
170. Fluoride	0.1

[a]MIX-L consisted of U141, U028, P020, U112, U226, U239, U080, U220, U166, U161, and U188.

Note: This table shows the concentrations in the untreated waste for all constituents that were detected in the untreated waste.

Source: Onsite Engineering Report for the Third Thirds Incineration Treatability Test (Reference 3).

Table 4-3

TREATMENT PERFORMANCE DATA COLLECTED BY EPA
FOR WASTES INCINERATED IN TEST 14
KILN ASH RESIDUAL

BDAT List Constituent	Concentration in Kiln Ash - Total Concentration (mg/kg) Sample Set #1	Sample Set #2	Sample Set #3	Sample Set #4
VOLATILE ORGANICS				
38. Methylene chloride	0.016	<0.010	<0.010	<0.010
METALS				
154. Antimony	<2.4	<2.4	<2.4	2.8
155. Arsenic	3.1	2.8	3.0	2.4
156. Barium	12.3	9.3	16.1	17.4
159. Chromium (total)	1.7	1.0	2.5	2.7
160. Copper	3.5	1.6	3.4	3.0
161. Lead	0.83	1.1	1.5	<2.8
163. Nickel	1.5	1.3	2.5	2.3
167. Vanadium	5.7	4.6	6.7	9.2
168. Zinc	2.7	3.7	3.6	3.5
PHENOXYACETIC ACID HERBICIDES				
192. 2,4-Dichloro-phenoxyacetic acid	<0.002	0.230	0.067	<0.002
TCLP METALS	Concentration in the TCLP Extract of the Kiln Ash (mg/l)			
155. Arsenic	0.012	0.014	0.011	0.011
156. Barium	0.28	0.267	0.0968	0.337
159. Chromium (total)	0.006	0.0052	0.0042	<0.003
160. Copper	0.021	0.0109	0.0184	0.0076
161. Lead	0.0062	<0.005	<0.005	0.0085
163. Nickel	<0.01	0.0105	<0.01	<0.01
167. Vanadium	<0.0519	0.0558	0.0524	0.0434
168. Zinc	0.202	0.135	0.0388	0.159

Note: This table shows the concentrations in the kiln ash for all constituents that were detected in the nonwastewater residuals generated from treatment of the waste.

Source: Onsite Engineering Report for the Third Thirds Incineration Treatability Test (Reference 3).

Table 4-4

DESIGN AND OPERATING DATA FOR THE ROTARY KILN AND SECONDARY COMBUSTOR USED IN TEST 14

Time of Data Collection	Corresponding Sample Set	Kiln Temperature (°F)	Clean Fill Soil Feed Rate (lbs/hr)	Liquids Mixture Feed Rate (gal/hr)	Kiln Rotational Speed (rpm)	Primary Afterburner Temperature (°F)	Natural Gas (Auxiliary Fuel) Feed Rate (ft^3/min)
0830	pre-test	1600-1800	540	0	0.25	1759-1797	10
0915	begin liquid feed	1600-1800	NR	24	NR	NR	NR
0930	pre-test	1600-1800	540	28	0.25	1759-1797	7.3
1000	pre-test	1600-1800	540	28	0.25	1759-1797	7.3
1055	sample set #1	1700	540	28	0.25	1701-1790	6.4
1145	sample set #2	1700	540	28	0.25	1761-1791	6.4
1215	sample set #2	1700	540	28	0.25	1761-1791	5.9
1245	sample set #3	1700	540	28	0.25	1776-1786	5.9
1315	sample set #3	1700	540	28	0.25	1776-1786	5.9
1345	sample set #4	1700-1800	540	28	0.25	1603-1989	5.7
1410	kiln shut off	1800	NR	NR	0.25	1768	NR

NR - Not Reported.

Source: Onsite Engineering Report for the Third Thirds Incineration Treatability Test (Reference 3).

Table 4-5

WASTE CHARACTERIZATION DATA COLLECTED BY EPA[a] FOR K103 AND K104

BDAT List Constituent	Concentration in the Untreated Waste[b] (ppm)							
	Sample Set #1		Sample Set #2		Sample Set #3		Sample Set #4	
	K103	K104	K103	K014	K013	K014	K103	K104
VOLATILE ORGANICS								
4. Benzene	81	240	73	320	55	11	32	4.5
48. Trichlorofluoromethane	<2.5	<10	<5	<20	<2.5	<0.5	<2.5	<0.25
SEMIVOLATILE ORGANICS								
56. Aniline	51,000	<150	33,000	<150	39,000	<300	53,000	<300
101. 2,4-Dinitrophenol	<7,500	<750	<7,500	<750	<15,000	<1,500	<15,000	<1,500
126. Nitrobenzene	<1,500	2,700	<1,500	2,200	<3,000	2,900	<3,000	3,900
142. Phenol	<1,500	<150	<1,500	<150	<3,000	<300	<3,000	<300
METALS								
155. Arsenic	<0.010	<0.010	<0.010	<0.100	0.021	<0.010	<0.500	<0.500
156. Barium	<0.001	0.0078	<0.001	0.0015	<0.001	0.017	<0.001	0.013
159. Chromium	<0.007	0.432	<0.007	0.097	<0.007	<0.007	<0.007	0.0071
160. Copper	<0.006	0.012	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
161. Lead	<0.005	<0.050	<0.005	<0.100	<0.005	<0.005	0.006	<0.050
163. Nickel	<0.011	0.238	<0.011	0.055	<0.011	<0.011	<0.011	0.014
167. Vanadium	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
168. Zinc	0.021	0.079	0.003	0.011	0.018	0.064	0.014	0.014
INORGANICS								
169. Total Cyanide	0.0748	6.28	0.0595	3.30	<0.0100	3.06	0.0384	4.44
170. Fluorides	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
171. Sulfides	89.0	<1.0[c]	89.0	<1.0[c]	62.0	<1.0[c]	80.0	<1.0[c]

[a]Reference: Onsite Engineering Report for E.I. Dupont de Nemours, Inc., Beaumont, Texas, Tables 4-1 through 4-3, 6-6, 6-8, and 6-14 (Reference 8).

[b]Data from one sample set (not shown here) were not used because the carbon adsorption unit was not operating properly at the time the sample was taken.

[c]Quantified below the detection limit due to interferences.

Table 4-6

TREATMENT PERFORMANCE DATA COLLECTED BY EPA[a] FROM LIQUID-LIQUID EXTRACTION FOLLOWED BY STEAM STRIPPING AND ACTIVATED CARBON ADSORPTION OF K103/K104

BDAT List Constituent	Concentration in the Treated Waste[b] (ppm)			
	Sample Set #1	Sample Set #2	Sample Set #3	Sample Set #4
VOLATILE ORGANICS				
4. Benzene	0.042	<0.005	0.019	0.011
48. Trichlorofluoromethane	0.007	0.010	<0.005	<0.005
SEMIVOLATILE ORGANICS				
56. Aniline	<0.030	<0.030	<0.030	0.960
101. 2,4-Dinitrophenol	0.380	0.320	0.260	0.230
126. Nitrobenzene	<0.030	<0.030	<0.030	<0.030
142. Phenol	<0.030	<0.030	<0.030	0.150
METALS				
155. Arsenic	<0.010	<0.100	<0.500	<0.010
156. Barium	0.032	0.042	0.076	0.073
159. Chromium	0.0097	0.024	<0.007	0.017
160. Copper	<0.006	<0.006	<0.006	<0.006
161. Lead	<0.500	<0.050	<0.005	<0.100
163. Nickel	<0.011	<0.011	0.015	0.030
167. Vanadium	0.014	0.012	<0.006	<0.006
168. Zinc	0.058	0.052	0.033	0.012
INORGANICS				
169. Total Cyanide	0.565	0.597	0.156	0.129
170. Fluorides	0.590	0.420	0.220	0.620
171. Sulfides	<1.0[c]	<1.0[c]	<1.0[c]	<1.0[c]

[a]Reference: Onsite Engineering Report for E.I. Dupont de Nemours, Inc., Beaumont, Texas, Tables 4-1 through 4-3, 6-6, 6-8, and 6-14 (Reference 8).

[b]Data from one sample set (not shown here) were not used because the carbon adsorption unit was not operating properly at the time the sample was taken.

cQuantified below the detection limit due to interferences.

Table 4-7

DESIGN AND OPERATING DATA FOR THE K103/K104 TEST OF LIQUID-LIQUID EXTRACTION FOLLOWED BY STEAM STRIPPING AND ACTIVATED CARBON ADSORPTION[a]

Operating Parameters	Design Value	Operating Data[b]			
		Sample Set #1	Sample Set #2	Sample Set #3	Sample Set #4
Aniline Liquid/Liquid Extractor:	Solvent:Nitrobenzene				
Feed Rate to the Extractor (lbs/hr)	7,000-25,000	14,400-14.500	15,900-16,000	14,900-15,200	14,800-14,900
Feed pH to the Extractor	9-10[c]	10.3	10.3	10.0	10.2
Feed Temperature to the Extractor (^{o}C)	40.0[c]	13.0	22.0	31.0	28.0
Nitrobenzene Liquid/Liquid Extractor	Solvent:Nitrobenzene				
Feed Rate to the Extractor (lbs/hr)	27,000-35,000	21,300-46,000[d]	9,800-26,000[d]	12,800-35,000[d]	24,700-31,500[d]
Feed pH to the Extractor	Max. 2.4	0.2	0.2	0.8	1.5
Feed Temperature to the Extractor (^{o}C)	25.0-65.0	39.0	43.0	50.0	47.5

[a]Reference: Onsite Engineering Report for E.I. duPont de Nemours, Inc., Beaumont, Texas, Tables 4-1 through 4-3, 6-6, 6-8, and 6-14 (Reference 8).
[b]Data from one sample set (not shown here) were not used because the carbon adsorption unit was not operating properly at the time the sample was taken.
[c]Not controlled. Normal operating value is given.
[d]Values outside the design range are instantaneous maximum or minimum. Refer to strip charts in Appendix G of K103/K104 OER (Reference 8).

Table 4-7 (Continued)

DESIGN AND OPERATING DATA FOR THE K103/K104 TEST OF LIQUID-LIQUID EXTRACTION FOLLOWED BY STEAM STRIPPING AND ACTIVATED CARBON ADSORPTION[a]

Operating Parameters	Design Value	Operating Data[b] Sample Set #1	Sample Set #2	Sample Set #3	Sample Set #4
Steam Stripper:					
Top Column Temperature (°C)	Min. 95.0	95[e]	102.2-103.3	102.9-103.0	102.6-102.7
Pressure Drop Across the Column (inches of water)	Max. 90.0	44.26-51.00	42.40-58.00	44.05-46.10	44.80-51.80
Feed Rate to Steam Stripper (lbs/hr)	20,000, Max. 90,000	59,400-59,480	49,000-60,100	60,300	57,590-57,660
Activated Carbon Adsorption					
Feed Rate to the System (lbs/hr)	Max. 65,300	61,600-68,600[d]	63,000-76,000	59,900-60,000	52,200-61,500
Feed pH to the System	Min. 7.0	10.6	4.6[d]	4.0[d]	3.5[d]
Feed Temperature to the System (°C)	40.0[c]	25.0	28.0	38.0	33.5
Total Organic Carbon in treated waste (mg/l)	Max. 250 Instantaneous	79.3	73.5	10.0	7.0
Calculated Residence time (minutes)	Min. 85	81-90[d]	73-88[d]	90-93	91-107

[a]Reference: Onsite Engineering Report for E.I. duPont de Nemours, Inc., Beaumont, Texas, Tables 4-1 through 4-3, 6-6, 6-8, and 6-14 (Reference 8).
[b]Data from one sample set (not shown here) were not used because the carbon adsorption unit was not operating properly at the time the sample was taken.
[c]Not controlled. Normal operating value is given.
[d]Values outside the design range are instantaneous maximum or minimum. Refer to strip charts in Appendix G of K103/K104 OER (Reference 8).
[e]Mid column substituted for top column temperature due to technical difficulties.

5.0 IDENTIFICATION OF BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)

This section discusses technologies that are available for treatment of K025 nonwastewaters and wastewaters and identifies BDAT for K025 nonwastewaters and wastewaters.

For a treatment technology to be identified as BDAT, the treatment performance data are first screened to determine whether they represent a well-designed and well-operated treatment system, whether sufficient analytical quality assurance/quality control measures were employed to ensure the accuracy of the data, and whether the appropriate measures of performance were used to assess the performance of the particular treatment technology.

The treatment performance data and the design and operating data collected during the test of rotary kiln incineration in Test 14 (Reference 3) and liquid-liquid extraction followed by steam stripping and activated carbon adsorption (Reference 8) were reviewed for the points described above. For both of these tests, the appropriate measure of performance (total constituent concentration) was used to assess the treatment systems. Additionally, the Agency had no reason to believe that these treatment systems were not well-designed and well-operated, or that insufficient analytical quality assurance/quality control measures were employed in generating treatment performance data.

An available treatment technology is one that (1) is not a proprietary or patented process that cannot be purchased or licensed from the proprietor (i.e., it must be commercially available), and (2) substantially diminishes the toxicity of the waste or substantially reduces the likelihood of migration of hazardous constituents from the waste. The technologies that are demonstrated for treatment of K025, incineration and liquid-liquid extraction followed by steam stripping and activated carbon adsorption (wastewaters only), are considered to be commercially available and to provide substantial treatment of the waste. Therefore, these treatment technologies are "available" for treatment of K025.

In summary, incineration and liquid-liquid extraction followed by steam stripping and activated carbon adsorption (wastewaters only) have been determined to be demonstrated and available for treatment of K025.

Because the Agency does not have treatment performance data for any other demonstrated and available technologies treating nonwastewater forms of K025 or similar wastes, incineration is considered to be the best. Therefore, the best demonstrated available technology (BDAT) for nonwastewater forms of K025 has been determined to be incineration.

In cases where the Agency has treatment performance data for demonstrated and available wastewater treatment processes and incineration (as measured by total constituent concentration in scrubber water), the Agency prefers to establish treatment standards based on the wastewater treatment

processes. Therefore, the best demonstrated available technology (BDAT) for wastewater forms of K025 has been determined to be liquid-liquid extraction followed by steam stripping and activated carbon adsorption.

As explained in Section 1.0 of this document, the Agency is specifying methods of treatment as alternatives to the numerical BDAT treatment standards because it is uncertain whether other constituents, which may not be controlled for by regulation of the BDAT List constituent proposed for regulation, are present in K025. Because the identities and physical properties of these constituents are not known, the Agency is proposing incineration as BDAT for nonwastewater and wastewater forms of K025 (in addition to liquid-liquid extraction and steam stripping followed by activated carbon adsorption for K025 wastewaters), since incineration is a technology that is applicable to treatment of most organic constituents and is also demonstrated and available for treatment of K025.

6.0 SELECTION OF CONSTITUENTS PROPOSED FOR REGULATION

The Agency has developed a list of hazardous constituents (the BDAT Constituent List, presented in EPA's Methodology for Developing BDAT Treatment Standards (Reference 1)) from which constituents to be regulated are selected for regulation. EPA may revise this list as additional data and information become available. The list is divided into the following categories: volatile organics, semivolatile organics, metals, inorganics other than metals, organochlorine pesticides, phenoxyacetic acid herbicides, organophosphorus insecticides, PCBs, and dioxins and furans. This section presents the rationale for the selection of constituents being proposed for regulation in wastewater and nonwastewater forms of K025.

Generally, constituents selected for proposed regulation must satisfy the following criteria:

(1) The constituent must be on the BDAT List of regulated constituents. Presence on the BDAT List means that approved methods to analyze for the constituent in treated waste matrices exist.

(2) The constituent must be present in, or be suspected of being present in, the untreated waste. For example, in some cases, analytical difficulties (such as masking) may prevent a constituent from being identified in the untreated waste, but its identification in a treatment residual may lead the Agency to conclude that it is present in the untreated waste.

From a group of constituents that are eligible for regulation, because they meet the above criteria, EPA may select a subset of constituents that represent the broader group. For example, from a group of constituents that react similarly to treatment, the Agency may select for regulation those

constituents that (1) are the most difficult to treat, based on waste characteristics affecting performance of treatment; (2) are representative of other constituents in the waste, based on structural similarities; or (3) are present in the untreated waste in the highest concentrations. Selecting a subset of constituents for regulation is done to facilitate implementation of the compliance and enforcement program.

The Agency initially considered all constituents on the BDAT List for regulation. However, the Agency may not regulate all of the BDAT List constituents considered for regulation. A BDAT List constituent is deleted from further consideration for regulation if (1) the constituent was not detected in the untreated and/or treated wastes or (2) the constituent was not analyzed for in the untreated waste.

Available K025 characterization data for all BDAT List constituents are summarized in Table 6-1 at the end of this section. The detected concentrations are shown in the table for all constituents quantified in the untreated K025. Constituents for which analytical results were not reported in available literature, identified in the table by the notation "NR" (not reported), were deleted from further consideration for proposed regulation.

The three BDAT List constituents that remained following these deletions were 2,4-dinitrotoluene, nitrobenzene, and 4-nitrophenol. These constituents were all quantified in untreated K025, thus satisfying the criteria discussed above for selecting regulated constituents. Accordingly,

these three BDAT List constituents were selected for proposed regulation in nonwastewater and wastewater forms of K025.

Table 6-1

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K025

BDAT Reference No.	Parameter	Concentration in Untreated K025 (ppm)
	Volatiles	
222.	Acetone	NR
1.	Acetonitrile	NR
2.	Acrolein	NR
3.	Acrylonitrile	NR
4.	Benzene	NR
5.	Bromodichloromethane	NR
6.	Bromomethane	NR
223.	n-Butyl alcohol	NR
7.	Carbon tetrachloride	NR
8.	Carbon disulfide	NR
9.	Chlorobenzene	NR
10.	2-Chloro-1,3-butadiene	NR
11.	Chlorodibromomethane	NR
12.	Chloroethane	NR
13	2-Chloroethyl vinyl ether	NR
14.	Chloroform	NR
15.	Chloromethane	NR
16.	3-Chloropropene	NR
17.	1,2-Dibromo-3-chloropropane	NR
18.	1,2-Dibromoethane	NR
19.	Dibromomethane	NR
20.	trans-1,4-Dichloro-2-butene	NR
21.	Dichlorodifluoromethane	NR
22.	1,1-Dichloroethane	NR
23.	1,2-Dichloroethane	NR
24.	1,1-Dichloroethylene	NR
25.	trans-1,2-Dichloroethene	NR
26.	1,2-Dichloropropane	NR
27.	trans-1,3-Dichloropropene	NR
28.	cis-1,3-Dichloropropene	NR
29.	1,4-Dioxane	NR
225.	Ethyl acetate	NR
226.	Ethyl benzene	NR
30.	Ethyl cyanide	NR
227.	Ethyl ether	NR
31.	Ethyl methacrylate	NR

NR - Not reported.

Source: Characterization of Waste Streams Listed in 40 CFR Section 261 Waste Profiles (Reference 6).

Table 6-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K025

BDAT Reference No.	Parameter	Concentration in Untreated K025 (ppm)
	Volatiles (Continued)	
214.	Ethylene oxide	NR
32.	Iodomethane	NR
33.	Isobutyl alcohol	NR
228.	Methanol	NR
34.	Methyl ethyl ketone	NR
229.	Methyl isobutyl ketone	NR
35.	Methyl methacrylate	NR
37.	Methacrylonitrile	NR
38.	Methylene chloride	NR
39.	Pyridine	NR
40.	1,1,1,2-Tetrachloroethane	NR
41.	1,1,2,2-Tetrachloroethane	NR
42.	Tetrachloroethene	NR
43.	Toluene	NR
44.	Tribromomethane	NR
45.	1,1,1-Trichloroethane	NR
46.	1,1,2-Trichloroethane	NR
47.	Trichloroethene	NR
48.	Trichloromonofluoromethane	NR
49.	1,2,3-Trichloropropane	NR
231.	1,1,2-Trichloro-1,2,2-trifluoroethane	NR
50.	Vinyl chloride	NR
215.	1,2-Xylene	NR
216.	1,3-Xylene	NR
217.	1,4-Xylene	NR
	Semivolatiles	
51.	Acenaphthalene	NR
52.	Acenaphthene	NR
53.	Acetophenone	NR
54.	2-Acetylaminofluorene	NR
233.	Acrylamide	NR
55.	4-Aminobiphenyl	NR
56.	Aniline	NR
56.	Aniline	NR
57.	Anthracene	NR

NR - Not reported.

Source: Characterization of Waste Streams Listed in 40 CFR Section 261 Waste Profiles (Reference 6).

Table 6-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K025

BDAT Reference No.	Parameter	Concentration in Untreated K025 (ppm)
	Semivolatiles (Continued)	
58.	Aramite	NR
59.	Benz(a)anthracene	NR
218.	Benzal chloride	NR
60.	Benzenethiol	NR
62.	Benzo(a)pyrene	NR
63.	Benzo(b)fluoranthene	NR
64.	Benzo(ghi)perylene	NR
65.	Benzo(k)fluoranthene	NR
66.	p-Benzoquinone	NR
67.	Bis(2-chloroethoxy)methane	NR
68.	Bis(2-chloroethyl)ether	NR
69.	Bis(2-chloroisopropyl)ether	NR
70.	Bis(2-ethylhexyl)phthalate	NR
71.	4-Bromophenyl phenyl ether	NR
72.	Butyl benzyl phthalate	NR
73.	2-sec-Butyl-4,6-dinitrophenol	NR
74.	p-Chloroaniline	NR
75.	Chlorobenzilate	NR
76.	p-Chloro-m-cresol	NR
77.	2-Chloronaphthalene	NR
78.	2-Chlorophenol	NR
80.	Chrysene	NR
81.	ortho-Cresol	NR
82.	para-Cresol	NR
232.	Cyclohexanone	NR
83.	Dibenz(a,h)anthracene	NR
84.	Dibenzo(a,e)pyrene	NR
86.	m-Dichlorobenzene	NR
87.	o-Dichlorobenzene	NR
88.	p-Dichlorobenzene	NR
89.	3,3'-Dichlorobenzidine	NR
234.	cis-1,4-Dichloro-2-butene	NR
90.	2,4-Dichlorophenol	NR
91.	2,6-Dichlorophenol	NR
92.	Diethyl phthalate	NR
93.	3,3'-Dimethoxybenzidine	NR
94.	p-Dimethylaminoazobenzene	NR

NR - Not reported.

Source: Characterization of Waste Streams Listed in 40 CFR Section 261 Waste Profiles (Reference 6).

Table 6-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K025

BDAT Reference No.	Parameter	Concentration in Untreated K025 (ppm)
	Semivolatiles (Continued)	
95.	3,3'-Dimethylbenzidine	NR
96.	2,4-Dimethylphenol	NR
97.	Dimethyl phthalate	NR
98.	Di-n-butyl phthalate	NR
99.	1,4-Dinitrobenzene	NR
100.	4,6-Dinitro-o-cresol	NR
101.	2,4-Dinitrophenol	NR
102.	2,4-Dinitrotoluene	186,000
103.	2,6-Dinitrotoluene	NR
104.	Di-n-octyl phthalate	NR
105.	Di-n-propylnitrosamine	NR
106.	Diphenylamine	NR
219.	Diphenylnitrosamine	NR
107.	1,2-Diphenylhydrazine	NR
108.	Fluoranthene	NR
109.	Fluorene	NR
110.	Hexachlorobenzene	NR
111.	Hexachlorobutadiene	NR
112.	Hexachlorocyclopentadiene	NR
113.	Hexachloroethane	NR
114.	Hexachlorophene	NR
115.	Hexachloropropene	NR
116.	Indeno(1,2,3-cd)pyrene	NR
117.	Isosafrole	NR
118.	Methapyrilene	NR
119.	3-Methylcholanthrene	NR
120.	4,4'-Methylenebis(2-chloroaniline)	NR
36.	Methyl methanesulfonate	NR
121.	Naphthalene	NR
122.	1,4-Naphthoquinone	NR
123.	1-Naphthylamine	NR
124.	2-Naphthylamine	NR
125.	p-Nitroaniline	404,000
126.	Nitrobenzene	31,000
127.	4-Nitrophenol	NR
128.	n-Nitrosodi-n-butylamine	NR
129.	n-Nitrosodiethylamine	

NR - Not reported.

Source: Characterization of Waste Streams Listed in 40 CFR Section 261 Waste Profiles (Reference 6).

Table 6-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K025

BDAT Reference No.	Parameter	Concentration in Untreated K025 (ppm)
	Semivolatiles (Continued)	
130.	n-Nitrosodimethylamine	NR
131.	n-Nitrosomethylethylamine	NR
132.	n-Nitrosomorpholine	NR
133.	n-Nitrosopiperidine	NR
134.	n-Nitrosopyrrolidine	NR
135.	5-Nitro-o-toluidine	NR
136.	Pentachlorobenzene	NR
137.	Pentachloroethane	NR
138.	Pentachloronitrobenzene	NR
139.	Pentachlorophenol	NR
140.	Phenacetin	NR
141.	Phenanthrene	NR
142.	Phenol	NR
220.	Phthalic anhydride	NR
144.	Pronamide	NR
145.	Pyrene	NR
146.	Resorcinol	NR
147.	Safrole	NR
148.	1,2,4,5-Tetrachlorobenzene	NR
149.	2,3,4,6-Tetrachlorophenol	NR
150.	1,2,4-Trichlorobenzene	NR
151.	2,4,5-Trichlorophenol	NR
152.	2,4,6-Trichlorophenol	NR
153.	Tris(2,3-dibromopropyl)phosphate	NR
	Metals	
154.	Antimony	NR
155.	Arsenic	NR
156.	Barium	NR
157.	Beryllium	NR
158.	Cadmium	NR
159.	Chromium (total)	NR
221.	Chromium (hexavalent)	NR
160.	Copper	NR
161.	Lead	NR
162.	Mercury	NR

NR - Not reported.

Source: Characterization of Waste Streams Listed in 40 CFR Section 261 Waste Profiles (Reference 6).

Table 6-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K025

BDAT Reference No.	Parameter	Concentration in Untreated K025 (ppm)
	Metals (Continued)	
163.	Nickel	NR
164.	Selenium	NR
165.	Silver	NR
166.	Thallium	NR
167.	Vanadium	NR
168.	Zinc	NR
	Inorganics	
169.	Cyanide	NR
170.	Fluoride	NR
171.	Sulfide	NR
	Organochlorine Pesticides	
172.	Aldrin	NR
173.	alpha-BHC	NR
174.	beta-BHC	NR
175	delta-BHC	NR
176.	gamma-BHC	NR
177.	Chlordane	NR
178.	DDD	NR
235.	o,p'-DDD	NR
179.	DDE	NR
236.	o,p'-DDE	NR
180.	DDT	NR
237.	o,p'-DDT	NR
181.	Dieldrin	NR
182.	Endosulfan I	NR
183.	Endosulfan II	NR
238.	Endosulfan sulfate	NR
184.	Endrin	NR
185.	Endrin aldehyde	NR
186.	Heptachlor	NR
187.	Heptachlor epoxide	NR

NR - Not reported.

Source: Characterization of Waste Streams Listed in 40 CFR Section 261 Waste Profiles (Reference 6).

Table 6-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K025

BDAT Reference No.	Parameter	Concentration in Untreated K025 (ppm)
	Organochlorine pesticides (Continued)	
188.	Isodrin	NR
189.	Kepone	NR
190.	Methoxychlor	NR
191.	Toxaphene	NR
	Phenoxyacetic acid herbicides	
192.	2,4-Dichlorophenoxyacetic acid	NR
193.	Silvex	NR
194.	2,4,5-T	NR
	Organophosphorous insecticides	
195.	Disulfoton	NR
196.	Famphur	NR
197.	Methyl parathion	NR
198.	Parathion	NR
199.	Phorate	NR
	PCBs	
200.	Aroclor 1016	NR
201.	Aroclor 1221	NR
202.	Aroclor 1232	NR
203.	Aroclor 1242	NR
204.	Aroclor 1248	NR
205.	Aroclor 1254	NR
206.	Aroclor 1260	NR
	Dioxins and furans	
207.	Hexachlorodibenzo-p-dioxins	NR
208.	Hexachlorodibenzofurans	NR
209.	Pentachlorodibenzo-p-dioxins	NR
210.	Pentachlorodibenzofurans	NR
211.	Tetrachlorodibenzo-p-dioxins	NR
212.	Tetrachlorodibenzofurans	NR
213.	2,3,7,8-Tetrachlorodibenzo-p-dioxin	NR

NR - Not reported.

Source: Characterization of Waste Streams Listed in 40 CFR Section 261 Waste Profiles (Reference 6).

7.0 CALCULATION OF PROPOSED BDAT TREATMENT STANDARDS

The Agency bases numerical treatment standards for regulated constituents on the performance of well-designed and well-operated BDAT treatment systems. These standards must account for analytical limitations in available treatment performance data, and the data must be adjusted for variabilities related to treatment, sampling, and analytical techniques and procedures. The purpose of this section is to calculate proposed treatment standards for K025 nonwastewaters and wastewaters for the constituents selected for proposed regulation using the available treatment performance data from the treatment technologies identified as BDAT.

Proposed BDAT treatment standards for K025 nonwastewaters are based on the demonstrated technology of incineration.

Proposed BDAT treatment standards for wastewater forms of K025 are based on the demonstrated technologies of liquid-liquid extraction, steam stripping, and activated carbon adsorption.

Before treatment standards are calculated, the treatment performance data are corrected to account for analytical interferences associated with the chemical matrices of the samples. A complete discussion of the accuracy correction of treatment data is provided in Appendix A. Appendix A also contains the matrix spike recoveries and accuracy correction factors used to

correct the treatment performance data, as well as the corrected treatment performance data.

After treatment performance data are corrected for accuracy, the arithmetic average of the corrected data is calculated for each regulated constituent. In cases where the constituent is not detected in the treatment residual at or above its detection limit, the detection limit is used to calculate the average constituent concentration in the treated waste. Tables 7-1 and 7-2 at the end of this section present the averages of the corrected treatment performance data for each constituent proposed for regulation in K025 nonwastewaters and wastewaters.

The next step in calculating treatment standards is to determine the variability factor (VF) for each regulated constituent. The variability factor accounts for the variability inherent in treatment system performance, treatment residual collection, and treatment sample analysis. (For more information on calculation of variability factors, see EPA's Methodology for Developing BDAT Treatment Standards (Reference 1).) Variability factors for the constituents proposed for regulation in K025 are shown in Tables 7-1 and 7-2.

Finally, the treatment standard is calculated for each constituent proposed for regulation by multiplying the average of the corrected treatment performance values by the variability factor for the constituent. Proposed treatment standards for nonwastewater and wastewater forms of K025 are

presented in Tables 7-1 and 7-2 and are discussed in greater detail in the following sections.

7.1 Calculation of Proposed Treatment Standards for K025 Nonwastewaters

Treatment performance data for the ash from rotary kiln incineration of K025 are not available. Therefore, the Agency is transferring performance data from treatment of organic constituents in the surrogate U and P wastes in Test 14 (listed in Table 4-1) to develop treatment standards for organic constituents in nonwastewater forms of K025. The rationale for this transfer is presented in Section 4.0 of this document.

Incineration generally results in the generation of ash (a nonwastewater) and combustion gas scrubber water (a wastewater). The best measure of performance for a destruction technology, such as incineration, is the total amount of each constituent of concern remaining after treatment. Therefore, BDAT treatment standards for organic constituents proposed for regulation in K025 nonwastewaters were calculated based on total constituent concentration data transferred from Test 14 incinerator ash (Reference 3).

Proposed treatment standards for organic constituents in K025 nonwastewaters were calculated using four sample sets of data for rotary kiln incineration of the surrogate U and P wastes used in Test 14 (Reference 3). Tables 4-2 and 4-3 of this document present the total concentrations of each organic constituent detected in the untreated surrogate U and P wastes and the

treated nonwastewater residual (ash). Treatment performance data for each constituent being proposed for regulation in K025 nonwastewaters were transferred from data for the same constituent in the wastes incinerated in Test 14 if that constituent was detected in those untreated wastes. For a constituent that was not detected in the untreated wastes that were incinerated in Test 14, a treatment standard was developed based on treatment performance data from another constituent that was detected in the untreated surrogate U and P wastes that were tested. The BDAT constituents proposed for regulation in nonwastewater forms of K025 were not detected in the untreated surrogate wastes that were incinerated in Test 14; accordingly, the proposed treatment standards for these constituents were developed based on treatment performance data for another constituent that was detected in the untreated surrogate wastes that were incinerated in Test 14.

The particular constituent from which data are transferred is determined based on the characteristics of the waste that affect treatment performance by incineration with respect to the nonwastewater residual (i.e., incinerator ash) and the structural similarities between the constituents from and to which data are transferred. In the rotary kiln, energy in the form of heat is transferred to the waste to volatilize the organic waste constituents. To determine whether one constituent is volatilized similarly to another constituent, the Agency examines the boiling points and the structural similarities of the constituents.

In general, the Agency believes that a constituent with a higher boiling point (bp) is more difficult to treat than a constituent with a lower boiling point. Whenever possible, treatment performance data were transferred to K025 nonwastewaters from constituents detected in untreated wastes incinerated in Test 14 that had equal or higher boiling points. Specific cases where data were transferred from another constituent are noted in Table 7-1 at the end of this section.

The calculation of the treatment standards for each BDAT List organic constituent proposed for regulation in K025 nonwastewaters is shown in Table 7-1.

7.2 Calculation of Proposed Treatment Standards for K025 Wastewaters

Treatment performance data from liquid-liquid extraction followed by steam stripping and activated carbon adsorption of K025 are not available. Therefore, the Agency is transferring performance data from treatment of organic constituents in K103 and K104 to develop treatment standards for organic constituents in wastewater forms of K025. The rationale for this transfer is presented in Section 4.0 of this document.

The best measure of performance for a removal technology, such as the treatment train described above, is the total amount of each constituent of concern remaining after treatment. Therefore, BDAT treatment standards for

organic constituents proposed for regulation in K025 wastewaters were calculated based on total constituent concentration data from K103 and K104.

Proposed treatment standards for organic constituents in K025 were calculated using four sample sets of data from liquid-liquid extraction followed by steam stripping and activated carbon adsorption of K103 and K104 (Reference 8). Tables 4-6 and 4-7 of this document present the total concentration of each organic constituent detected in the untreated K103 and K104 and the treatment residual, respectively. Treatment performance data for each constituent being proposed for regulation in K025 wastewaters were transferred from data for the same constituent in K103 and K104 if that constituent was detected in the untreated K103 and K104. For a constituent that was not detected in the untreated K103 and K104, a treatment standard was developed based on treatment performance data from another constituent that was detected in the untreated K103 and K104 that were tested. Two of the BDAT List constituents proposed for regulation in wastewater forms of K025 were not detected in the untreated K103 and K104; accordingly, the proposed treatment standards for these constituents were developed based on treatment performance data for other constituents that were detected in the untreated K103 and K104.

The particular constituent from which data are transferred is determined based on the characteristics of the waste that affect treatment performance of liquid-liquid extraction followed by steam stripping and activated carbon adsorption. To determine whether one constituent is treated similarly to another constituent, the Agency examines the boiling points and

structural similarities of the constituents and the physical properties of the wastes, including total organic carbon content and concentrations of suspended solids, oil and grease, volatile organic compounds, and aromatic compounds.

The Agency believes that K025 is similar to K103 and K104 with respect to the properties of the wastes and the waste constituents discussed above. Therefore, the Agency believes that K025 would be similar to K103 and K104 in terms of treatment by liquid-liquid extraction followed by steam stripping and activated carbon adsorption. Specific cases where data were transferred from another constituent are noted in Table 7-2 at the end of this section.

The calculation of the treatment standards for each BDAT List organic constituent proposed for regulation in K025 wastewaters is shown in Table 7-2.

Table 7-1

CALCULATION OF TREATMENT STANDARDS FOR CONSTITUENTS PROPOSED FOR REGULATION IN K025

NONWASTEWATERS

BDAT List Constituent Proposed for Regulation	Constituent from Which Treatment Performance Data In Test 14 Were Transferred	Arithmetic Average of Corrected Treatment Performance Values (ppm)	Variability Factor (VF)	Treatment Standard[a] (Average x VF) (ppm)
102. 2,4-Dinitrotoluene	2-sec-Butyl-4,6-dinitrophenol	0.82	2.8	2.3
126. Nitrobenzene	2-sec-Butyl-4,6-dinitrophenol	0.82	2.8	2.3
127. 4-Nitrophenol	2-sec-Butyl-4,6-dinitrophenol	0.82	2.8	2.3

[a]The treatment standard values shown in this table have been rounded off to show two significant figures.

Table 7-2

CALCULATION OF TREATMENT STANDARDS FOR CONSTITUENTS PROPOSED FOR REGULATION IN K025

WASTEWATERS

BDAT List Constituent Proposed for Regulation	Constituent from Which Treatment Performance Data in K103/K104 Were Transferred	Arithmetic Average of Corrected Treatment Performance Values (ppm)	Variability Factor (VF)	Treatment Standard[a] (Average x VF) (ppm)
102. 2,4-Dinitrotoluene	2,4-Dinitrophenol	0.408	1.648	0.67
126. Nitrobenzene	Nitrobenzene	0.030	2.8	0.084
127. 4-Nitrophenol	2,4-Dinitrophenol	0.408	1.648	0.67

[a]The treatment standard values shown in this table have been rounded off to show two significant figures.

8.0 ACKNOWLEDGEMENTS

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The following personnel from Radian Corporation were involved in preparing this document: Mr. John Williams, Program Manager; Ms. Lori Stoll, Project Director; and the Radian engineering team, Ms. Debra Falatko, Ms. Chrisanti Haretos, and Ms. Colleen Kane.

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Appendix A

ACCURACY CORRECTION OF TREATMENT PERFORMANCE DATA

Appendix A

ACCURACY CORRECTION OF TREATMENT PERFORMANCE DATA

The treatment performance data used to determine treatment standards for K025 were adjusted to account for analytical interferences associated with the chemical matrices of the samples. Generally, treatment performance data were corrected for accuracy as follows: (1) a matrix spike recovery was determined for each BDAT List constituent detected in the untreated or treated waste; (2) an accuracy correction factor was determined for each of the above constituents by dividing 100 by the matrix spike recovery (percent) for that constituent; and (3) treatment performance data for each BDAT List constituent detected in the untreated or treated waste were corrected by multiplying the reported concentration of each constituent by its corresponding accuracy correction factor. The procedure for accuracy correction of the data is described in further detail below.

Matrix spike recoveries are developed by analyzing a sample of a treated waste for a constituent and then re-analyzing the sample after the addition of a known amount of the same constituent (i.e., spike) to the sample. The matrix spike recovery represents the total amount of constituent recovered after spiking, minus the initial concentration of the constituent in the sample, and the result divided by the spike concentration of the constituent.

Matrix spike recoveries that were used to adjust the treatment performance data transferred to K025 are shown in Tables A-1 and A-2. Duplicate matrix spikes were performed for some BDAT List constituents. If a duplicate matrix spike was performed for a constituent, the matrix spike recovery used for that constituent was the lower of the two values from the first matrix spike and the duplicate spike. An accuracy correction factor of 1 was used when matrix spike and duplicate matrix spike recoveries both exceeded 100%, so that the data were not adjusted to concentrations below the detection limits.

Where a matrix spike was not performed for an organic constituent, the matrix spike recovery for that constituent was derived from the average matrix spike recoveries of the appropriate group of constituents (e.g., volatile or semivolatile organics) for which recovery data were available. In these cases, the matrix spike recoveries for all volatiles or semivolatiles from the first matrix spike were averaged. Similarly, an average matrix spike recovery was calculated for the duplicate matrix spike recoveries. The lower of the two average matrix spike recoveries of the volatile or semivolatile group was used for any volatile or semivolatile constituent for which no matrix spike was performed.

The accuracy correction factors for the data that were used to adjust the treatment performance data transferred to K025 are presented in Table A-3. The corrected treatment concentrations for the constituents

proposed for regulation in K025 nonwastewaters and wastewaters are presented in Tables A-4 and A-5.

Table A-1

MATRIX SPIKE RECOVERIES FOR KILN ASH RESIDUAL FROM TEST 14

	Spike Constituent	Original Amount Found[a] (ppm)	Sample Result			Duplicate Sample Result		
			Amount Spiked (ppm)	Amount Recovered (ppm)	Percent Recovery[b] (%)	Amount Spiked (ppm)	Amount Recovered (ppm)	Percent Recovery[b] (%)
VOLATILE ORGANICS								
4.	Benzene	ND	0.050	0.052	103	0.050	0.049	97
9.	Chlorobenzene	ND	0.050	0.058	115	0.050	0.055	109
24.	1,1-Dichloroethene	ND	0.050	0.038	75	0.050	0.037	73
229.	4-Methyl-2-pentanone	ND	0.050	0.024	48	0.050	0.022	43
38.	Methylene chloride	ND	0.050	0.060	120	0.050	0.062	124
43.	Toluene	ND	0.050	0.054	109	0.050	0.052	103
45.	1,1,1-Trichloroethane	ND	0.050	0.054	109	0.050	0.055	110
47.	Trichloroethene	ND	0.050	0.054	109	0.050	0.051	103
215-217.	Total Xylenes	ND	0.050	0.046	92	0.050	0.045	91

[a]For constituents not detected in the treatment residual at or above the detection limit (ND), the original amount found is considered zero in calculating percent recovery.

[b]Percent recovery = 100 x $((C_i-C_o)/C_t)$, where C_o is the concentration of the original amount found, C_i is the concentration of the amount recovered, and C_t is the concentration of the amount spiked.

Source: Draft Onsite Engineering Report of the Third Thirds Incineration Treatability Test at the John Zink Company, Tulsa, Oklahoma. (Reference 3).

Table A-1 (Continued)

MATRIX SPIKE RECOVERIES FOR KILN ASH RESIDUAL FROM TEST 14

	Spike Constituent	Original Amount Found[a] (ppm)	Sample Result: Amount Spiked (ppm)	Sample Result: Amount Recovered (ppm)	Sample Result: Percent Recovery[b] (%)	Duplicate Sample Result: Amount Spiked (ppm)	Duplicate Sample Result: Amount Recovered (ppm)	Duplicate Sample Result: Percent Recovery[b] (%)
SEMIVOLATILE ORGANICS (ACID EXTRACTABLES)								
73.	2-sec-Butyl-4,6-dinitrophenol	ND	0.200	0.082	41	0.200	0.082	41
76.	p-Chloro-m-cresol	ND	6.580	5.950	90	6.490	5.110	79
78.	2-Chlorophenol	ND	6.580	3.470	53	6.490	2.690	41
127.	4-Nitrophenol	ND	6.580	5.070	77	6.490	4.140	64
139.	Pentachlorophenol	ND	6.580	5.070	77	6.490	4.500	69
142.	Phenol	ND	6.580	4.600	70	6.490	3.890	60
SEMIVOLATILE ORGANICS (BASE/NEUTRAL FRACTION)								
52.	Acenaphthene	ND	3.290	1.990	60	3.240	1.740	54
70.	Bis(2-ethylhexyl)-phthalate	ND	0.200	0.155	78	0.200	0.142	71
88.	1,4-Dichlorobenzene	ND	3.290	0.949	29	3.240	0.558	17
102.	2,4-Dinitrotoluene	ND	3.290	2.350	71	3.240	2.040	63
105.	N-Nitroso-di-n-propylamine	ND	3.290	1.740	53	3.240	1.500	46
110.	Hexachlorobenzene	ND	0.100	0.074	74	0.100	0.139	139
117.	Isosafrole	ND	0.100	0.044	44	0.100	0.039	39
144.	Pronamide	ND	0.100	0.092	92	0.100	0.084	84
145.	Pyrene	ND	3.290	2.390	73	3.240	2.130	66
150.	1,2,4-Trichlorobenzene	ND	3.290	1.200	36	3.240	0.774	24

[a]For constituents not detected in the treatment residual at or above the detection limit (ND), the original amount found is considered zero in calculating percent recovery.

[b]Percent recovery = 100 x $((C_i-C_o)/C_t)$, where C_o is the concentration of the original amount found, C_i is the concentration of the amount recovered, and C_t is the concentration of the amount spiked.

Source: Draft Onsite Engineering Report of the Third Thirds Incineration Treatability Test at the John Zink Company, Tulsa, Oklahoma. (Reference 3).

Table A-2

MATRIX SPIKE RECOVERIES FOR WASTEWATER TREATMENT RESIDUAL

Spike Constituent	Original Amount Found[a] (ppm)	Sample Result: Amount Spiked (ppm)	Sample Result: Amount Recovered (ppm)	Sample Result: Percent Recovery[b] (%)	Duplicate Sample Result: Amount Recovered (ppm)	Duplicate Sample Result: Percent Recovery[b] (%)
VOLATILE ORGANICS						
4. Benzene	0.018	0.050	0.058	76	0.065	94
9. Chlorobenzene	ND	0.050	0.044	88	0.048	96
22. 1,1-Dichloroethane	ND	0.050	0.064	128	0.072	144
43. Toluene	ND	0.050	0.045	90	0.055	108
47. Trichloroethene	ND	0.050	0.053	106	0.059	118

[a]For constituents not detected in the treatment residual at or above the detection limit (ND), the original amount found is considered zero in calculating percent recovery.

[b]Percent recovery = 100 x $((C_i-C_o)/C_t)$, where C_o is the concentration of the original amount found, C_i is the concentration of the amount recovered, and C_t is the concentration of the amount spiked.

Source: Onsite Engineering Report of Treatment Performance Operation at E.I. duPont de Nemours, Inc., Beaumont, TX, for K103 and K104. (Reference 8).

Table A-2 (Continued)

MATRIX SPIKE RECOVERIES FOR WASTEWATER TREATMENT RESIDUAL

	Spike Constituent	Original Amount Found[a] (ppm)	Sample Result			Duplicate Sample Result	
			Amount Spiked (ppm)	Amount Recovered (ppm)	Percent Recovery[b] (%)	Amount Recovered (ppm)	Percent Recovery[b] (%)
SEMIVOLATILE ORGANICS (ACID EXTRACTABLES)							
76.	4-Chloro-3-methylphenol	ND	0.200	0.145	72	0.120	60
78.	2-Chlorophenol	ND	0.200	0.030	15	0.026	13
127.	4-Nitrophenol	ND	0.200	0.312	156	0.270	135
139.	Pentachlorophenol	ND	0.200	0.188	94	0.141	71
142.	Phenol	ND	0.200	0.063	21	0.051	26
SEMIVOLATILE ORGANICS (BASE/NEUTRAL FRACTION)							
51.	Acenaphthene	ND	0.100	0.070	70	0.067	67
56.	Aniline	ND	0.200	0.194	97	0.182	91
88.	1,4-Dichlorobenzene	ND	0.100	0.033	37	0.037	37
102.	2,4-Dinitrotoluene	ND	0.100	0.120	120	0.123	123
105.	n-Nitroso-di-n-propylamine	ND	0.100	0.097	97	0.098	98
126.	Nitrobenzene	ND	0.200	0.232	116	0.229	115
145.	Pyrene	ND	0.100	0.107	107	0.103	103
150.	1,2,4-Trichlorobenzene	ND	0.100	0.035	35	0.038	38

[a]For constituents not detected in the treatment residual at or above the detection limit (ND), the original amount found is considered zero in calculating percent recovery.

[b]Percent recovery = 100 x $((C_i-C_o)/C_t)$, where C_o is the concentration of the original amount found, C_i is the concentration of the amount recovered, and C_t is the concentration of the amount spiked.

Source: Onsite Engineering Report of Treatment Performance Operation at E.I. duPont de Nemours, Inc., Beaumont, TX, for K103 and K104. (Reference 8).

Table A-3

SUMMARY OF ACCURACY CORRECTION FACTORS

BDAT List Constituent		Accuracy Correction Factor[a]	
		Nonwastewater	Wastewater
4.	Benzene	NA	1.316
38.	Methylene chloride	1.000	NA
43.	Toluene	1.000	NA
45.	1,1,1-Trichloroethane	1.000	NA
48.	Trichloromonofluoromethane	NA	1.020
56.	Aniline	NA	1.099
70.	Bis(2-ethylhexyl)phthalate	1.408	NA
73.	2-sec-Butyl-4,6-dinitrophenol	2.439	NA
101.	2,4-Dinitrophenol	NA	1.370
117.	Isosafrole	2.564	NA
122.	1,4-Naphthoquinone	1.639	NA
126.	Nitrobenzene	NA	1.000
142.	Phenol	1.667	4.762
229.	Methyl isobutyl ketone	2.326	NA

[a] The accuracy correction factor is equal to 100 divided by the percent recovery. An accuracy correction factor of 1 was used when matrix spike and duplicate matrix spike recoveries both exceeded 100%, so that the data were not adjusted to concentrations below the detection limits.

NA - Not applicable.

Table A-4

ACCURACY-CORRECTED DATA USED TO CALCULATE TREATMENT STANDARDS
FOR CONSTITUENTS PROPOSED FOR REGULATION IN K025 NONWASTEWATERS

BDAT List Constituent	Sample Set:	Corrected Total Concentration[a] in the Test 14 Incinerator Ash (ppm) 1	2	3	4
VOLATILE ORGANICS					
38. Methylene chloride		0.016	0.010	0.010	0.010
229. Methyl isobutyl ketone		0.047	0.047	0.047	0.047
43. Toluene		0.010	0.010	0.010	0.010
45. 1,1,1-Trichloroethane		0.010	0.010	0.010	0.010
SEMIVOLATILE ORGANICS					
70. Bis(2-ethylhexyl)phthalate		0.51	0.46	0.46	0.46
73. 2-sec-Butyl-4,6-dinitrophenol		0.88	0.80	0.80	0.80
117. Isosafrole		0.92	0.85	0.85	0.85
122. 1,4-Naphthoquinone		0.59	0.54	0.54	0.54
142. Phenol		0.60	0.55	0.55	0.55

[a]Constituent concentrations have been corrected by multiplying the concentration by the accuracy correction factor (ACF) for each constituent.

Table A-5

ACCURACY-CORRECTED DATA USED TO CALCULATE TREATMENT STANDARDS
FOR CONSTITUENTS PROPOSED FOR REGULATION IN K025 WASTEWATERS

	Corrected Total Concentration[a] in the K103/K104 Wastewater Treatment Residual (ppm)			
Sample Set:	1	2	3	4
BDAT List Constituent				
VOLATILE ORGANICS				
4. Benzene	0.055	0.0066	0.025	0.014
48. Trichloromonofluoromethane	0.0072	0.010	0.0051	0.0051
SEMIVOLATILE ORGANICS				
56. Aniline	0.033	0.033	0.033	1.0
101. 2,4-Dinitrophenol	0.52	0.44	0.36	0.32
126. Nitrobenzene	0.03	0.03	0.03	0.03
142. Phenol	0.14	0.14	0.14	0.71

[a]Constituent concentrations have been corrected by multiplying the concentration by the accuracy correction factor (ACF) for each constituent.